



System Constraints and Phosphorus Trends in the Everglades

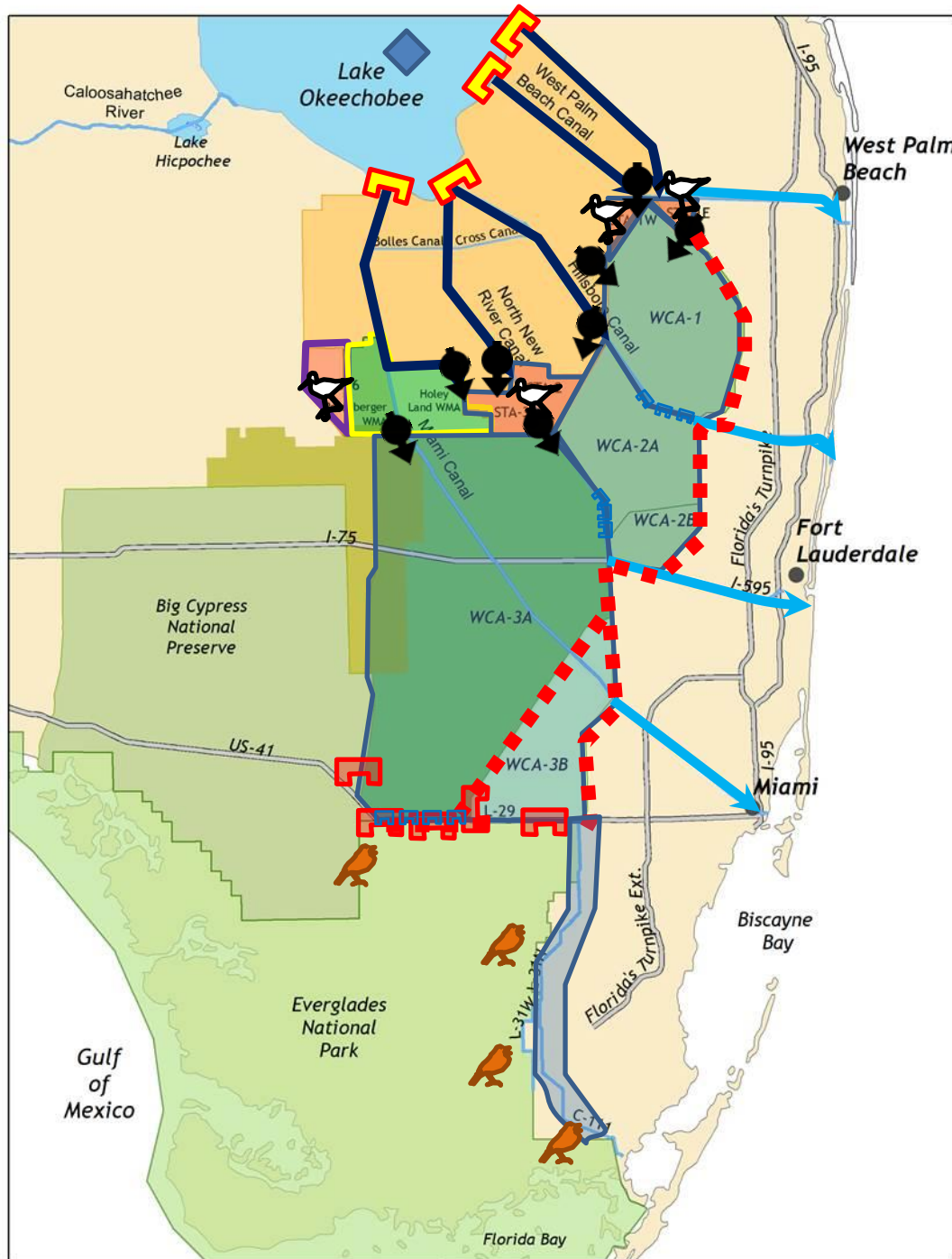
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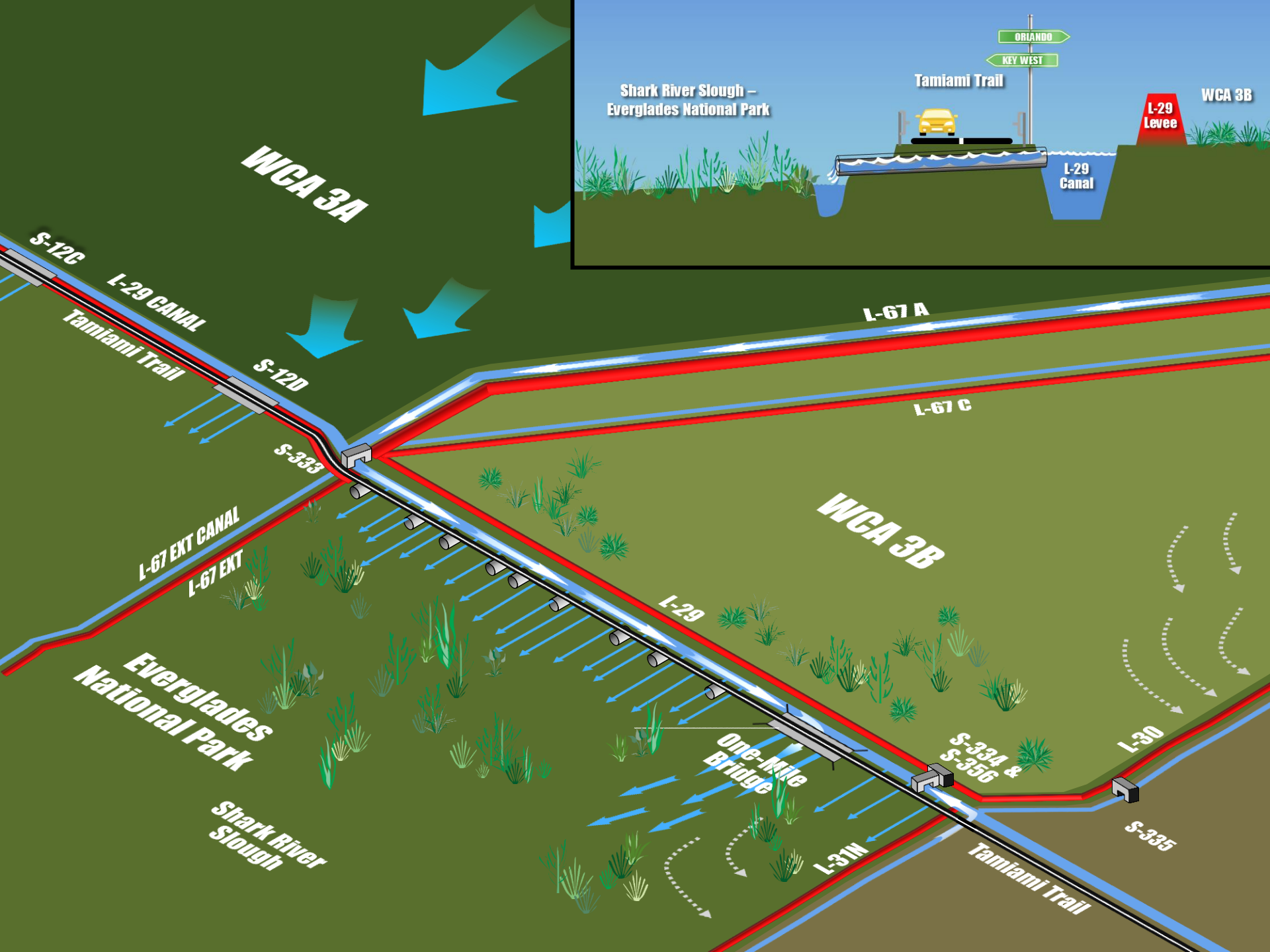


Presentation Outline

- System Constraints
- How Water Flows into Everglades National Park
- Overview of Phosphorus Trends in the Everglades
- The Changing System with Mod Waters & CEPP



Symbol	Constraint
	2008 LORS
	Structure Capacity
	Canal Conveyance
	Species protection
	STA Treatment Capability
	Pump Capacity
	STA 5 / 6 Connectivity
	Wildlife Management Area
	Water Level Limitation (Tree Island & Wildlife)
	LEC Canal Conveyance
	Levee Safety
	Flow Limitation
	Flood Risk (G3273, SDCS)





Phosphorus Trends in the Everglades - Overview



Phosphorus Requirements for the Everglades Protection Area

- Maintenance of state water quality standards is crucial to the ecology of the WCAs and Everglades National Park
- Legal requirements to reduce phosphorus levels in discharges and achieve water quality standards
 - 1992 (and amendments) Settlement Agreement/Consent Decree (Appendix A/B)
 - 1994 (and amendments) Everglades Forever Act
 - Numeric phosphorus criterion throughout the EPA marsh/WQBELS



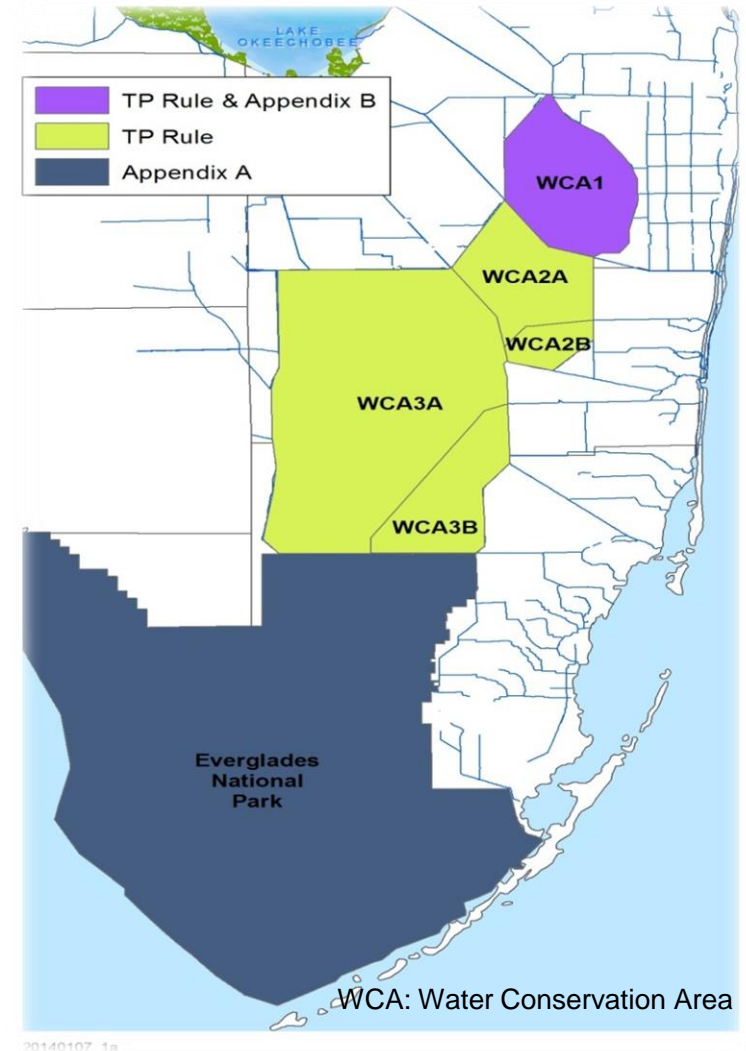
Phosphorus Requirements for the Everglades Protection Area

- Projects to achieve and maintain water quality standards
 - EAA & C-139 BMP Program (from 1996)
 - STAs (1994 – 2012)
 - Restoration Strategies Expanded STA/FEB (from 2013)
- Integration with Federal projects (Modified Water Deliveries) and CERP projects (CEPP)



Settlement Agreement & State Phosphorus Requirements

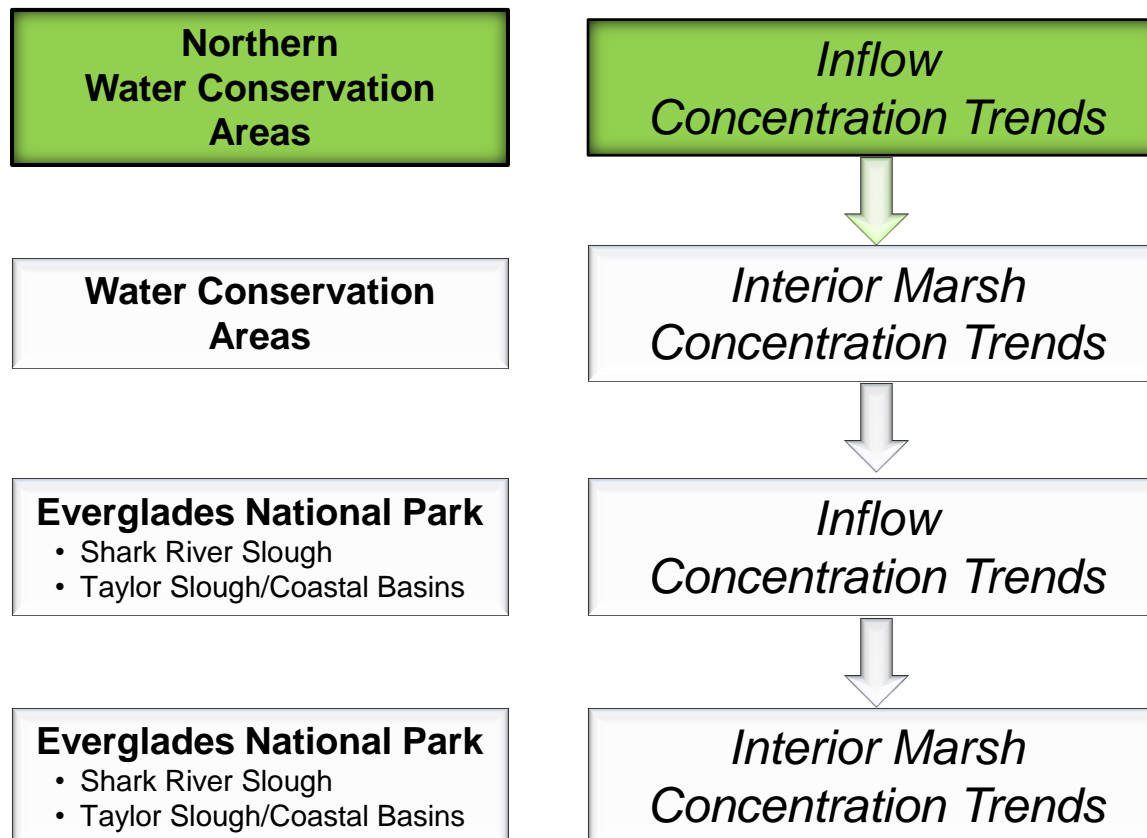
- WCA-1 (Refuge)
 - Settlement Agreement Appendix B, and
 - State Phosphorus Rule (10 ppb)
- WCA-2 & WCA-3
 - Settlement Agreement does not apply
 - State Phosphorus Rule (10 ppb)
- Everglades National Park
 - Settlement Agreement Appendix A (Appendix A limit also adopted in state phosphorus rule)





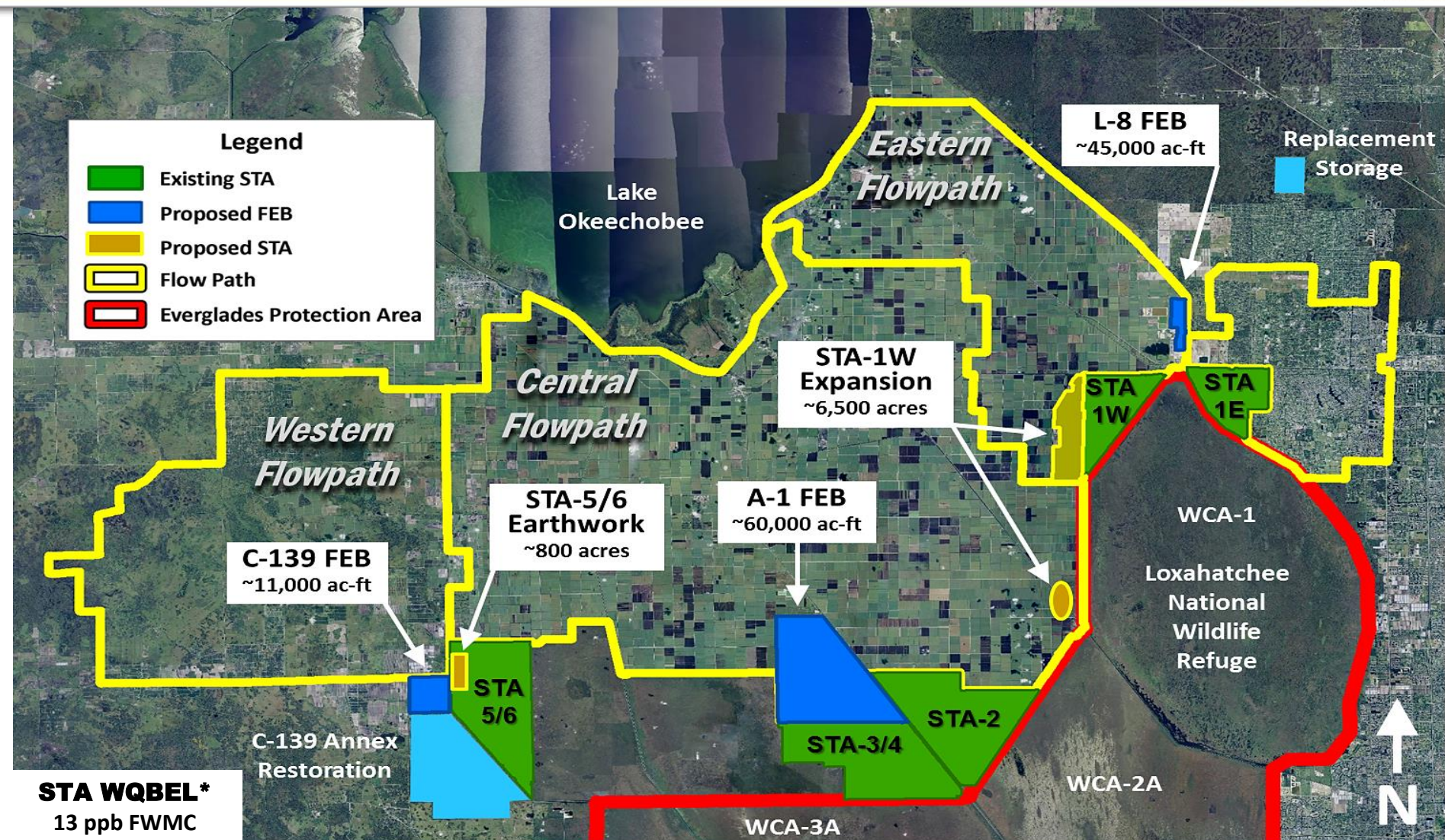
Phosphorus Trends in the Everglades Protection Area

Overview





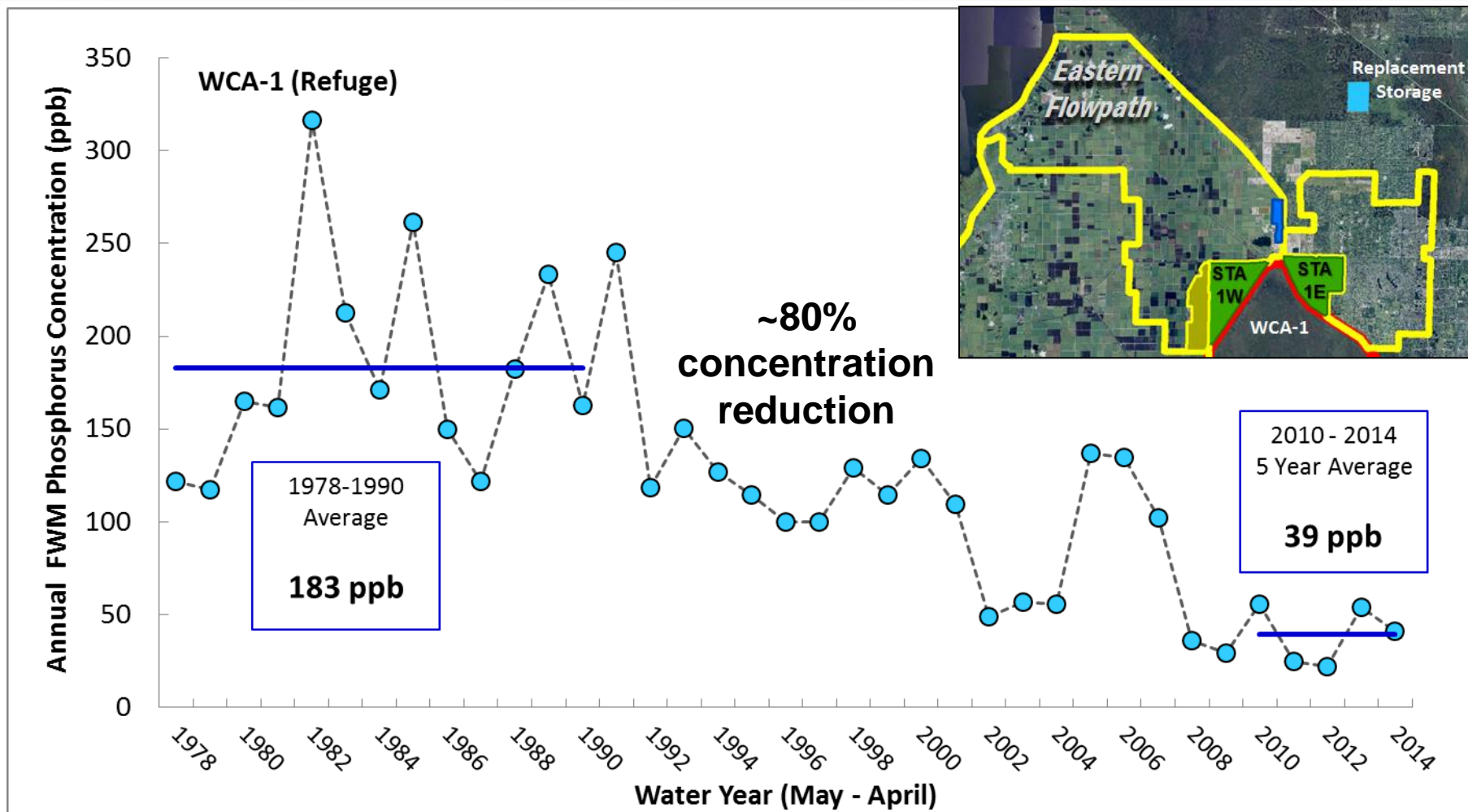
Inflows to the Northern Water Conservation Areas



*WQBEL – water quality based effluent limit; FWMC – flow weighted mean concentration



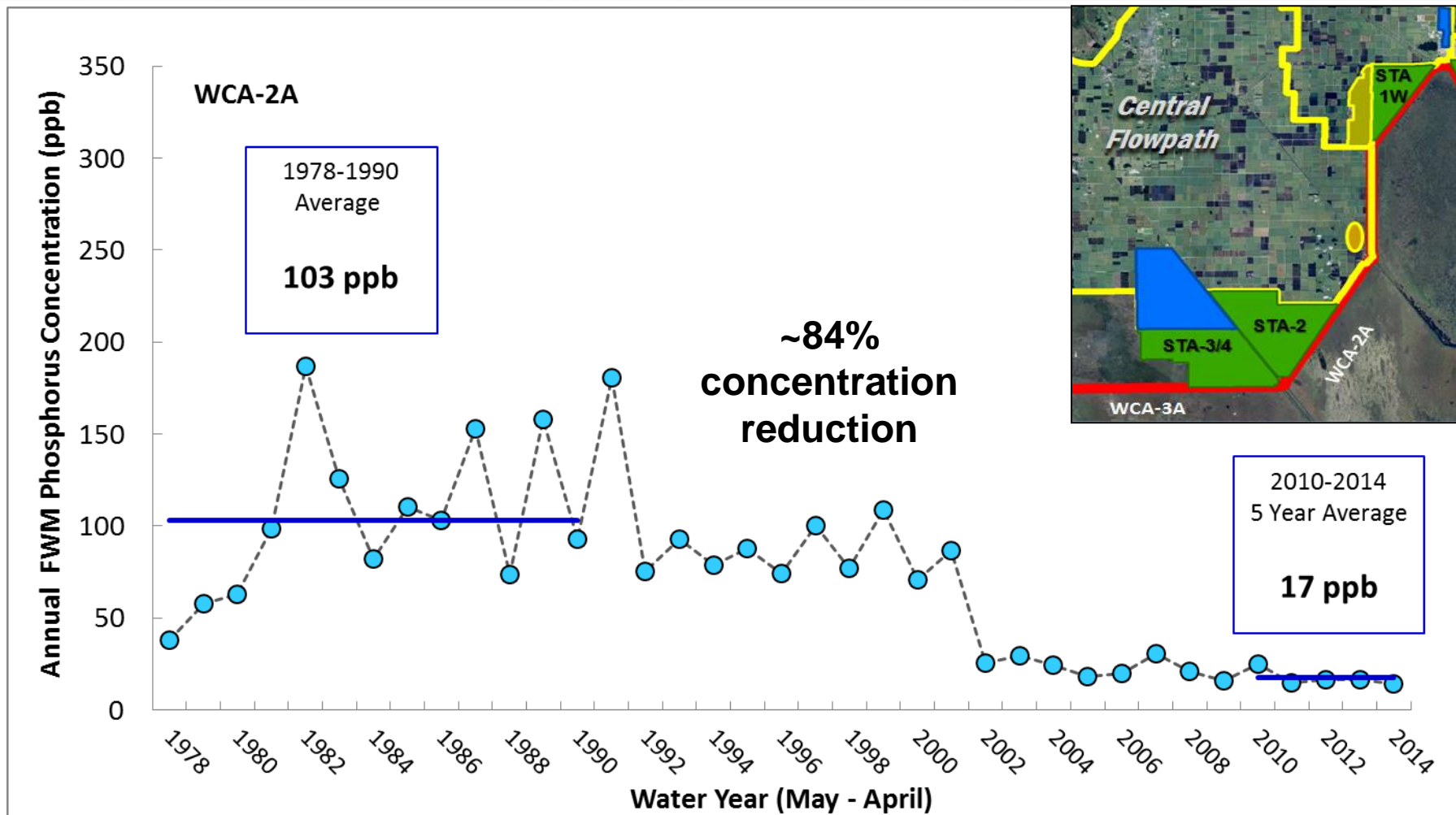
Water Conservation Area 1 (Refuge) Inflow Phosphorus Concentration Trends



FWMC – flow weighted mean concentration BMPs – Best Management Practices



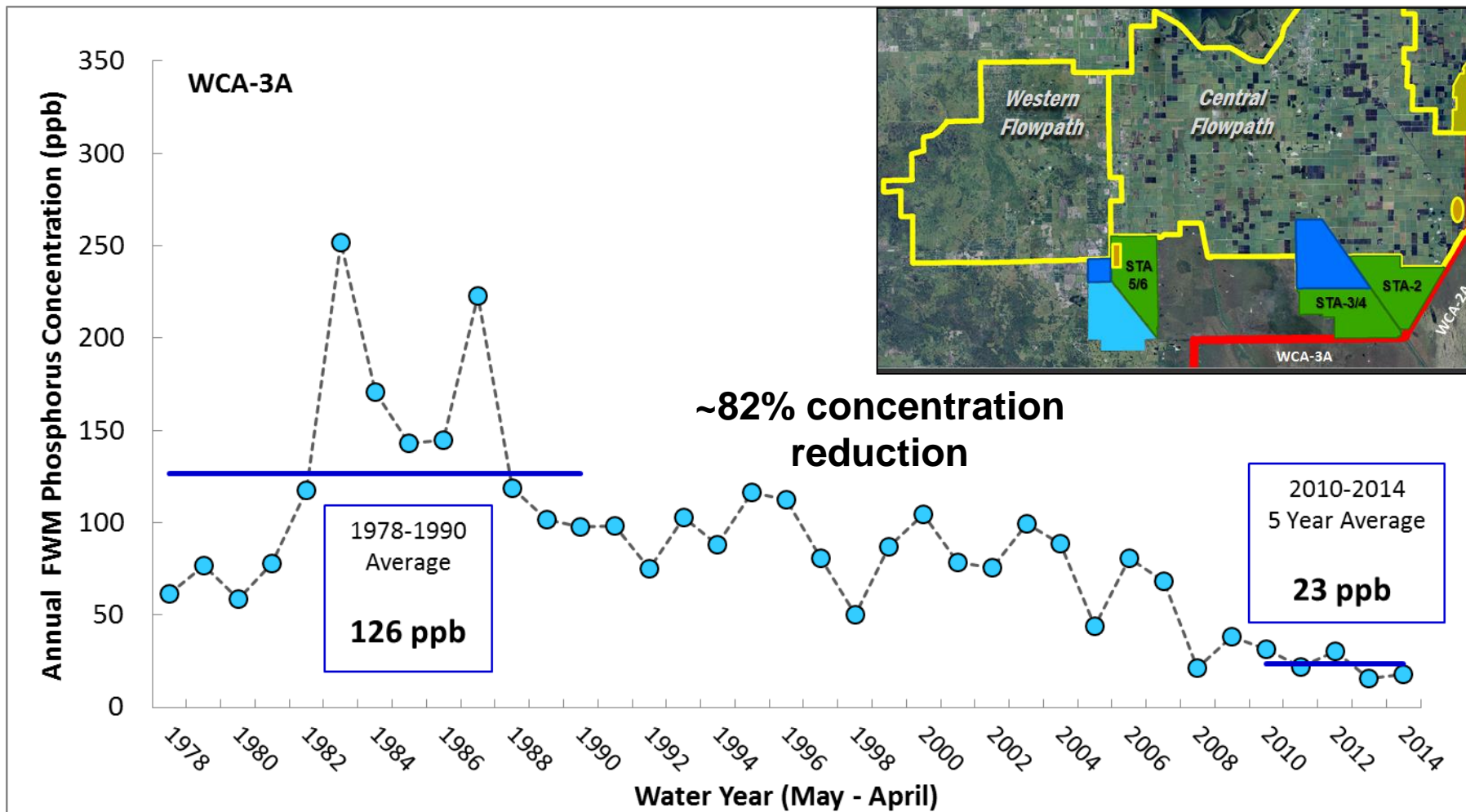
Water Conservation Area 2A Inflow Phosphorus Concentration Trends



FWMC – flow weighted mean concentration



Water Conservation Area 3A Inflow Phosphorus Concentration Trends

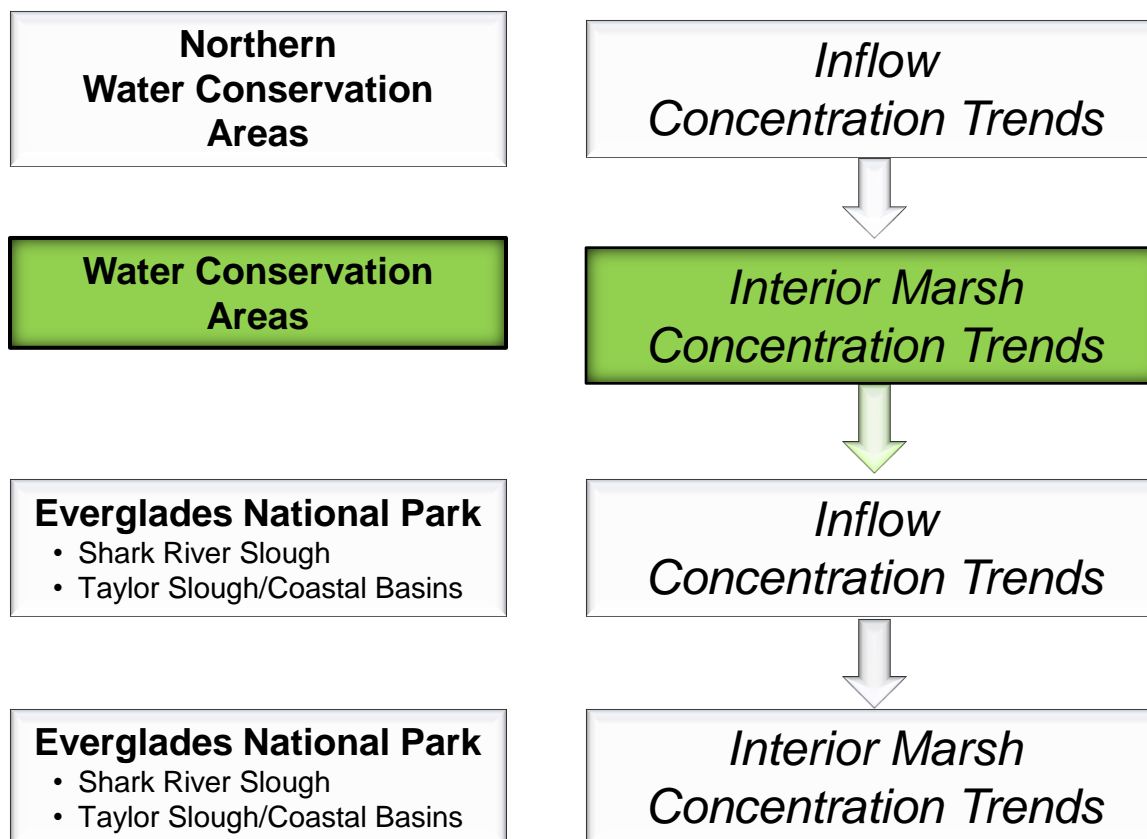


FWMC – flow weighted mean concentration BMPs – Best Management Practices



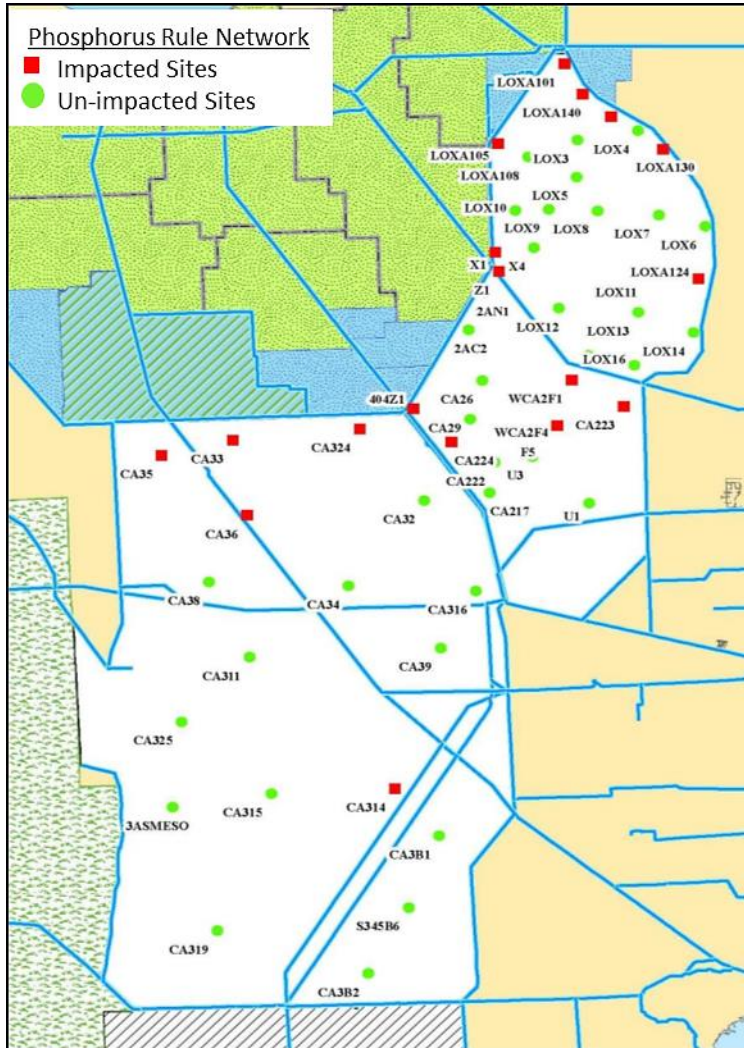
Phosphorus Trends in the Everglades Protection Area

Overview





Water Conservation Areas Marsh Phosphorus Trends



■ WCA-1 (Refuge)

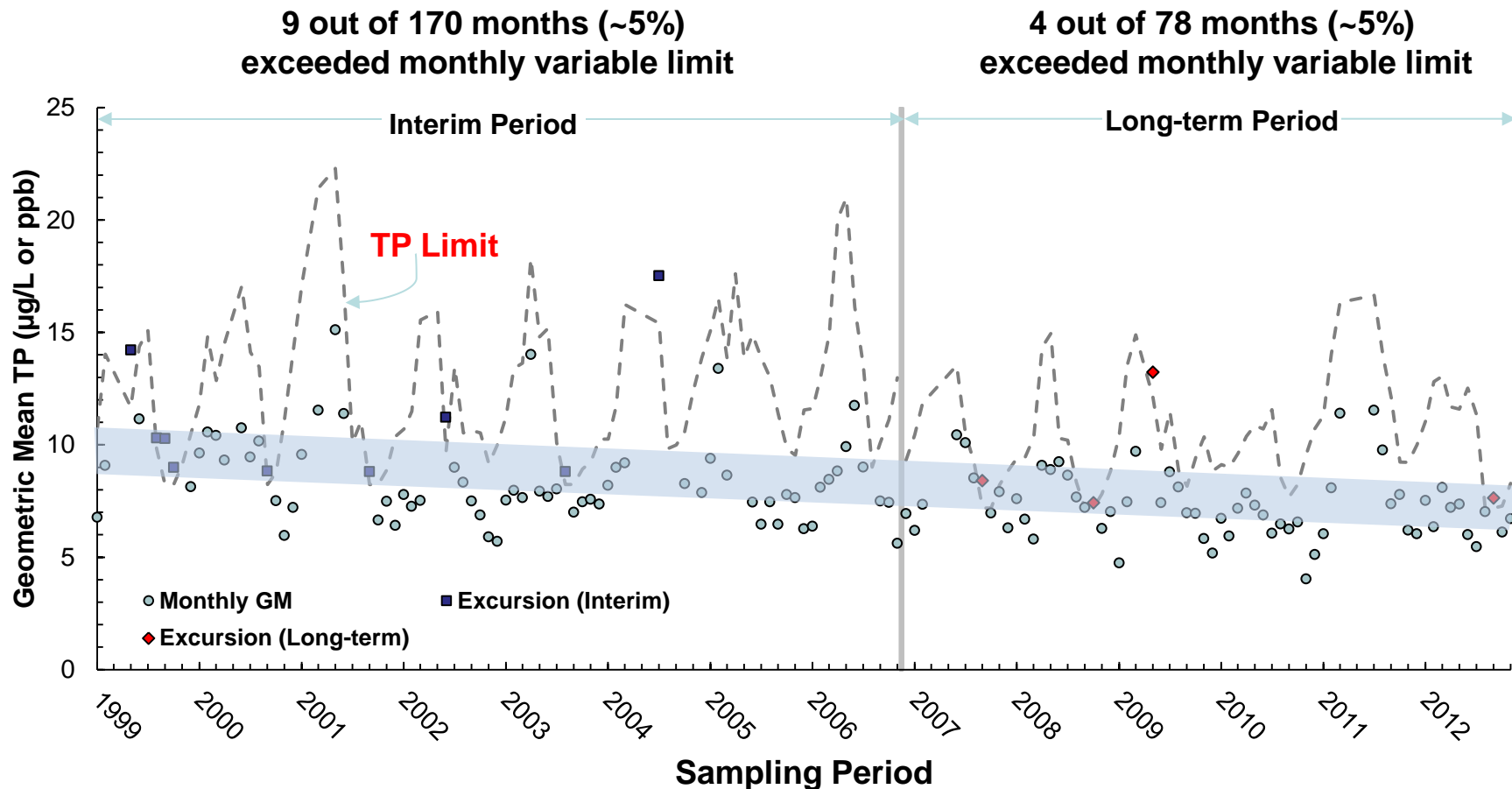
- Settlement Agreement, Appendix B
 - Long-term Limit: Concentration varies with Stage (inverse relationship)
 - Achievement:
 - Varies 7.2 ppb – 17.6 ppb (geometric mean)
 - No more than 1 in 12 months can exceed limit

■ All WCAs

- State Phosphorus Rule
 - “Impacted” and “Un-impacted” network of sites (separately assessed)
 - Long-term Criterion: 4-Part Test
 - Achievement in each WCA:
 - Do not exceed 5-yr average 10 ppb (geometric mean)
 - Do not exceed 3 other spatial / temporal related tests



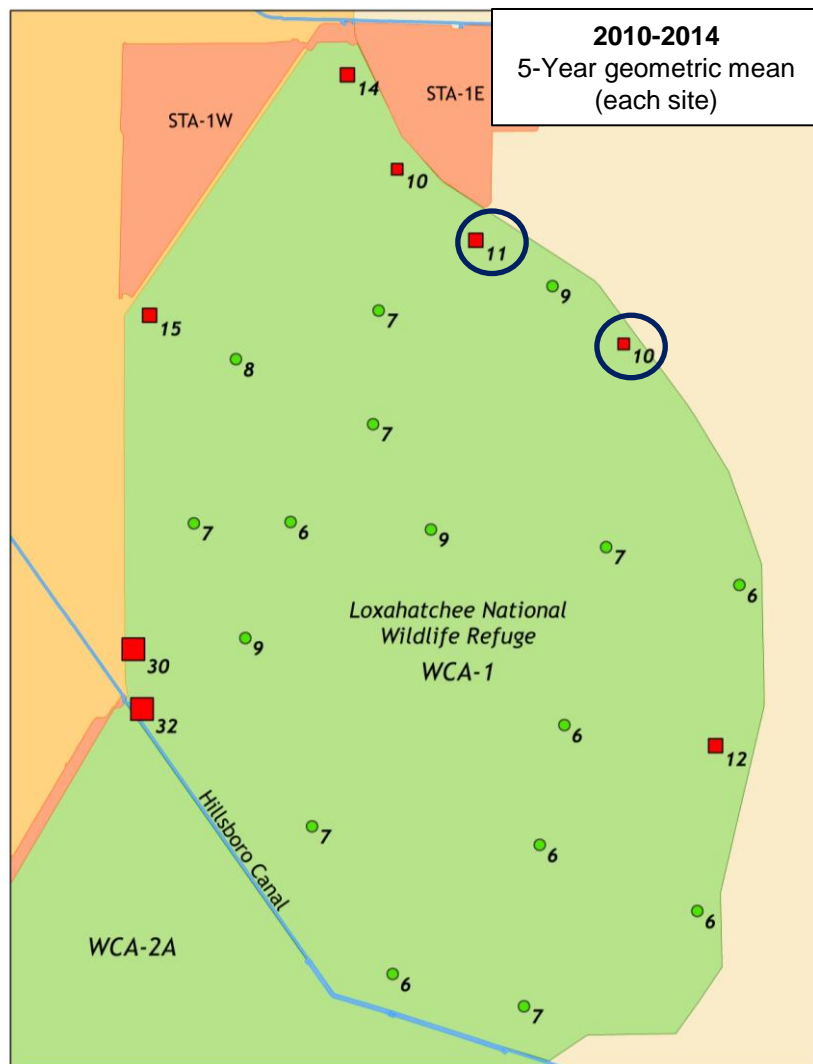
Water Conservation Area 1 (Refuge) Settlement Agreement – App. B / Interior Marsh Trends



TP concentrations from 14 Interior Refuge marsh sites used to determine Appendix B achievement



WCA-1 (Refuge) State TP Rule / Interior Marsh Trends



2010 - 2014 **Network Average**

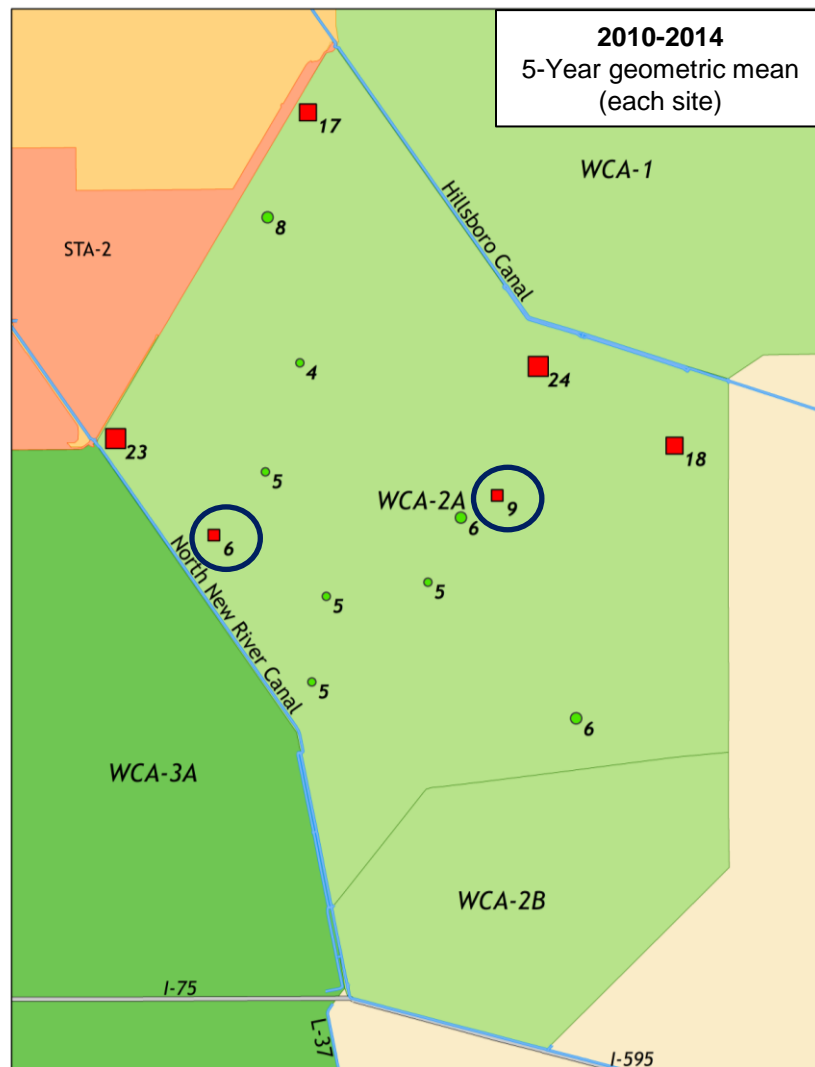
■ Impacted
5-yr GM = 18 ppb
Range = 15 - 24 ppb

● Un-Impacted
5-yr GM = 7 ppb
Range = 7 – 8 ppb

GM = geometric mean
Range = annual average



WCA-2A State TP Rule / Interior Marsh Trends



2010 - 2014 Network Average

■ **Impacted**
5-yr GM = 20 ppb
Range = 15 - 24 ppb

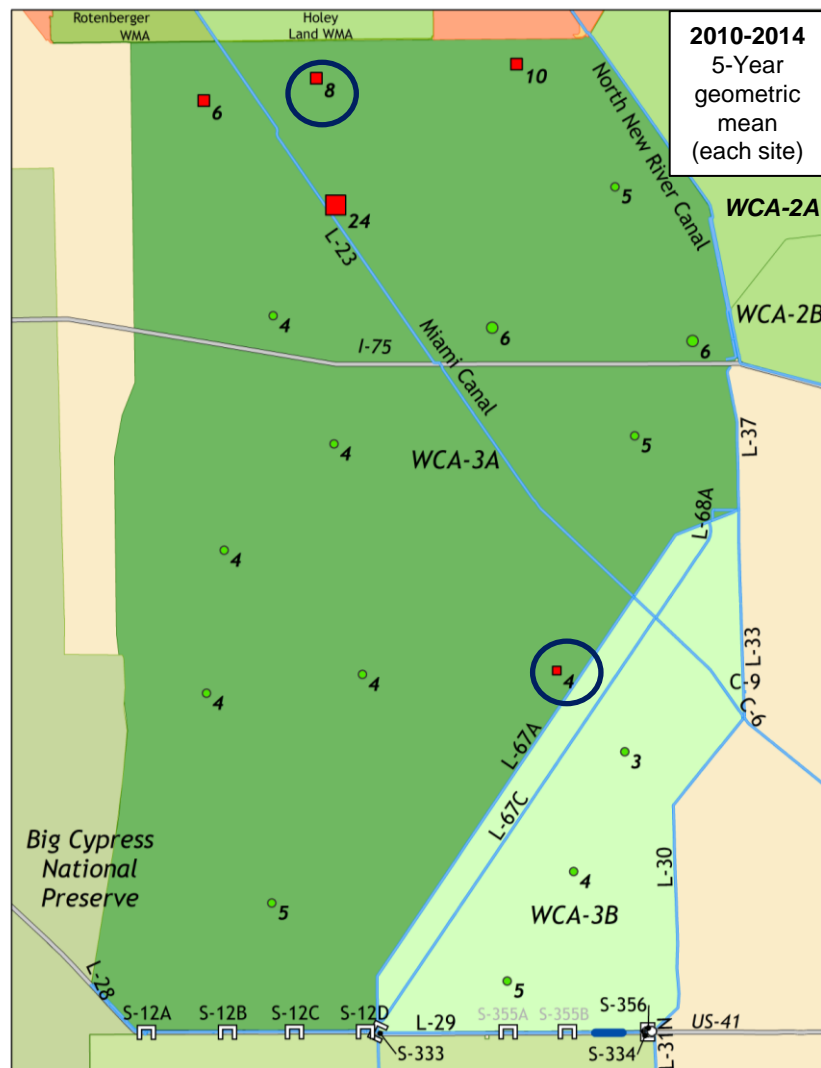
● **Un-Impacted**
5-yr GM = 6 ppb
Range = 5 - 6 ppb

GM = geometric mean
Range = annual average



WCA-3A

State TP Rule / Interior Marsh Trends



2010 - 2014 Network Average

■ Impacted
5-yr GM = 15 ppb
Range = 10 - 31 ppb

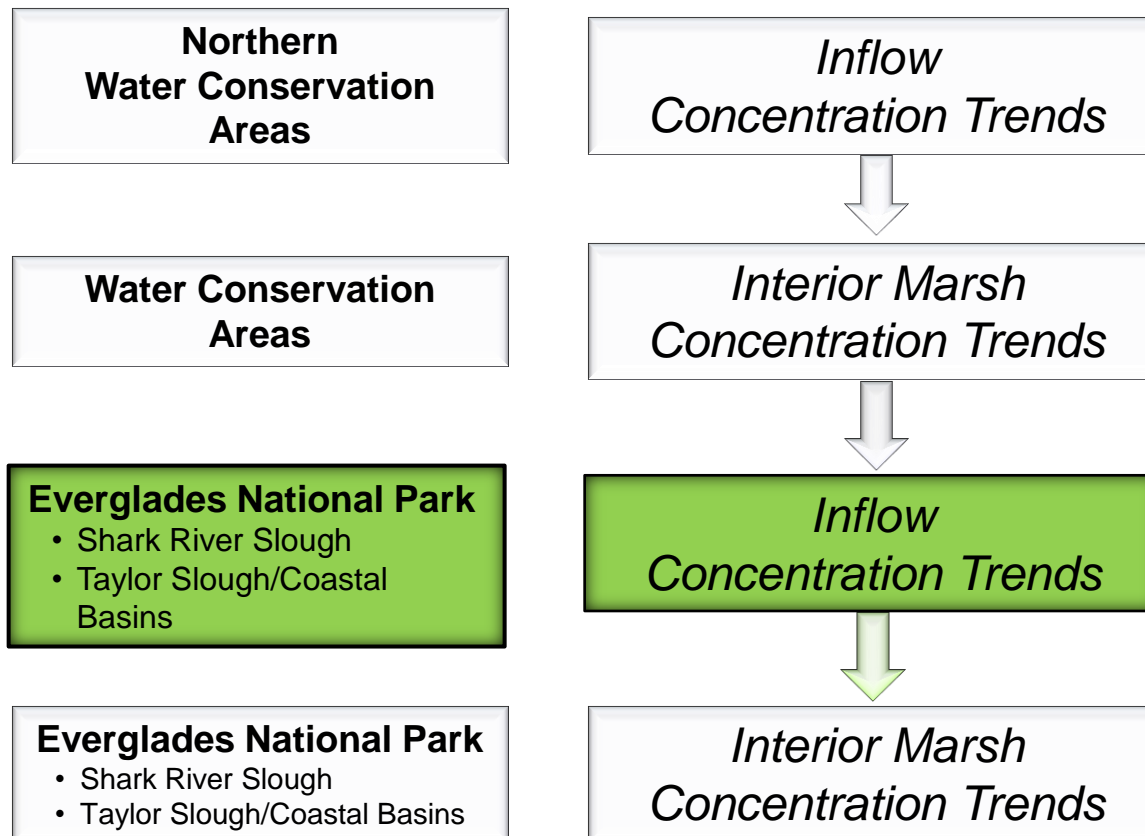
● Un-Impacted
5-yr GM = 6 ppb
Range = 4 – 6 ppb

GM = geometric mean
Range = annual average



Phosphorus Trends in the Everglades Protection Area

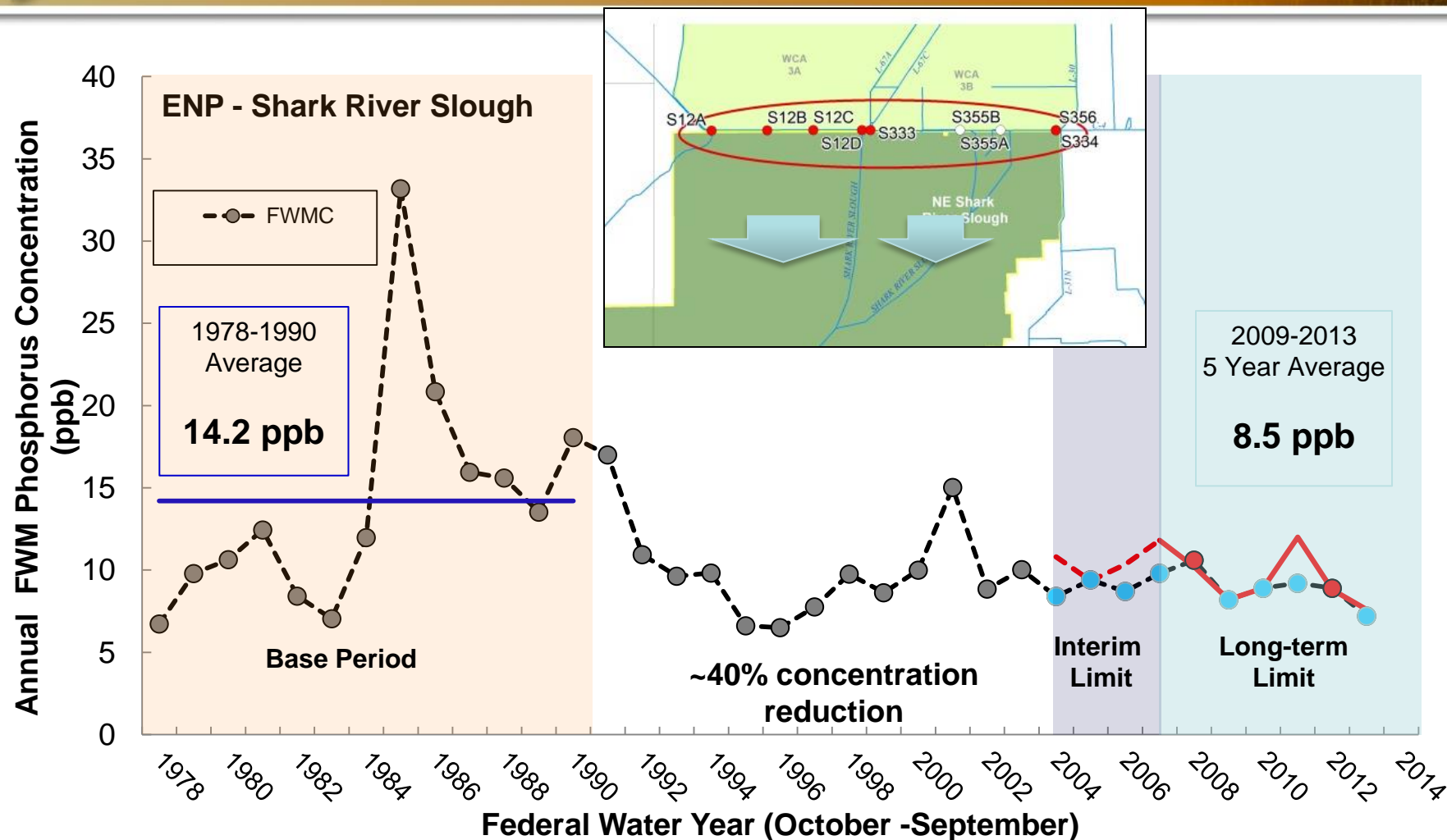
Overview





Shark River Slough

Appendix A – Inflow Phosphorus Trends

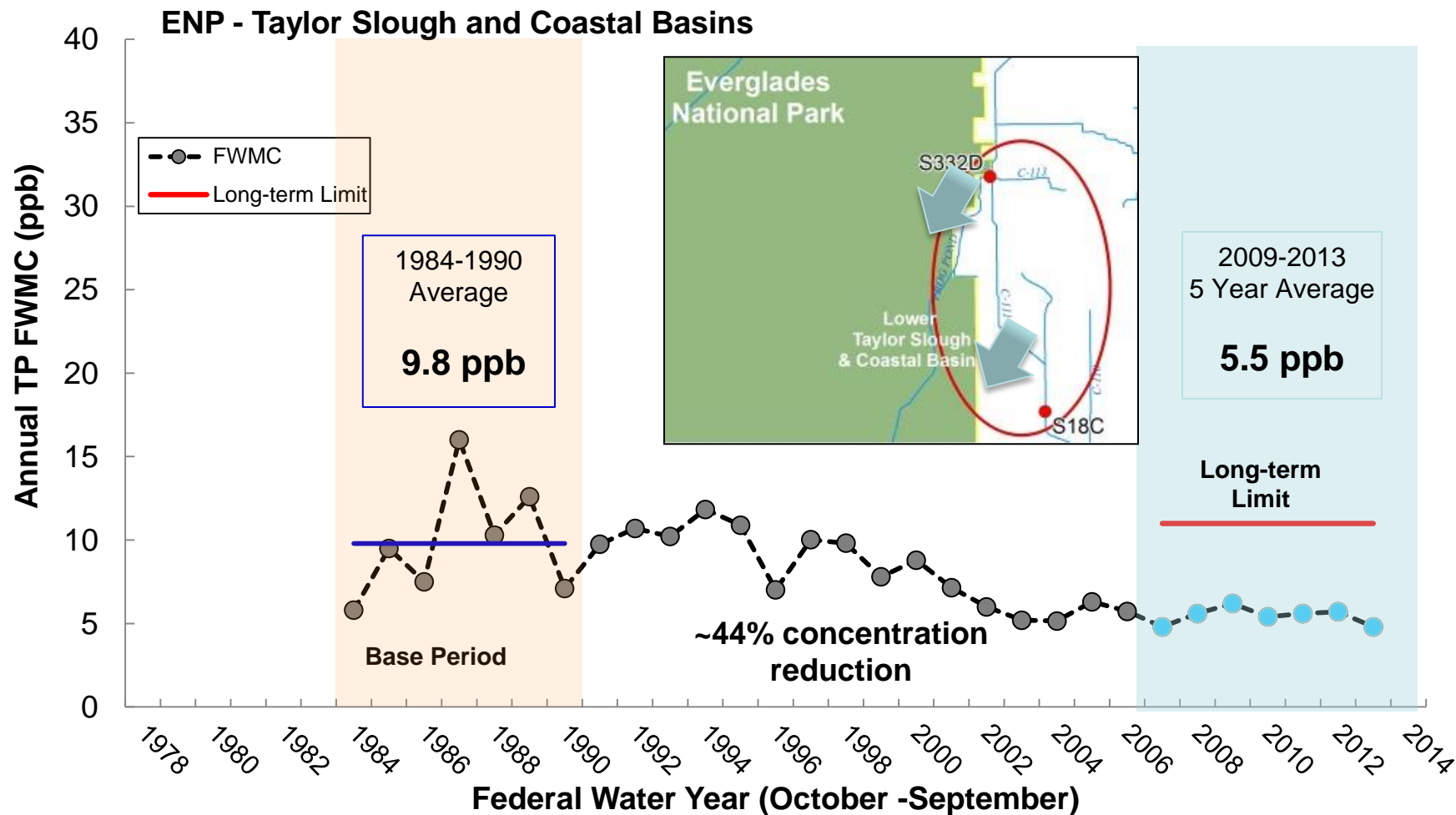


FWMC – flow weighted mean concentration



Taylor Slough & Coastal Basins

Appendix A – Inflow Phosphorus Trends

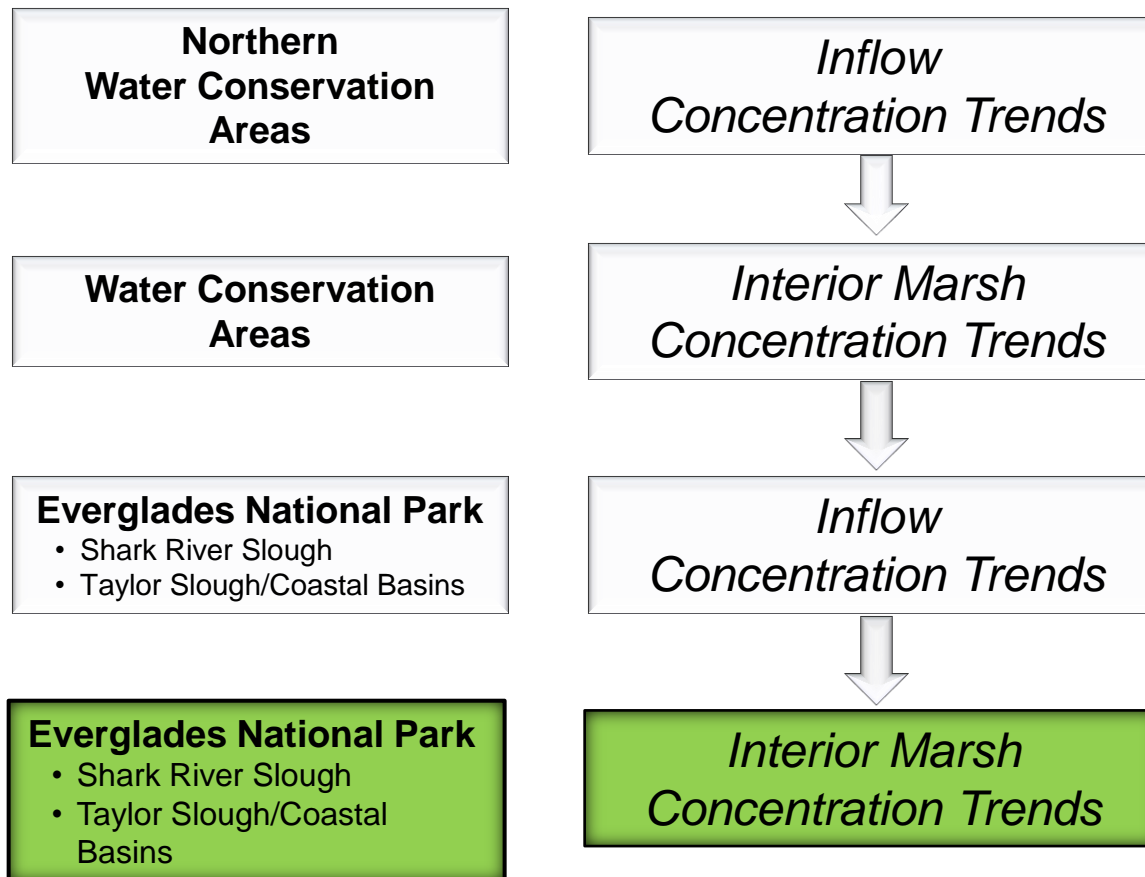


FWMC – flow weighted mean concentration



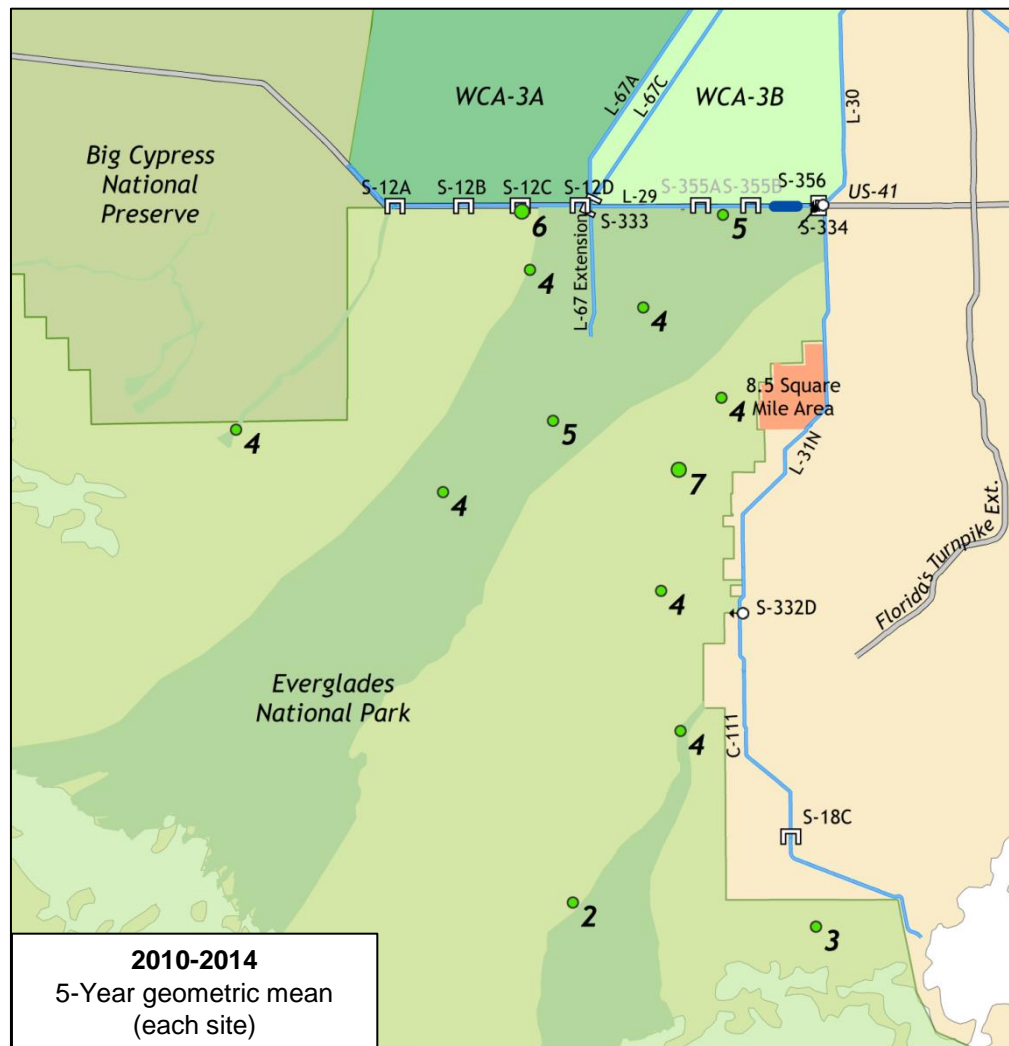
Phosphorus Trends in the Everglades Protection Area

Overview





Everglades National Park Marsh Phosphorus Trends



2010 - 2014 Network Average

Shark River Slough

● Un-Impacted
5-yr GM = 6 ppb
Range = 4 – 7 ppb

Taylor Slough/Coastal Basins

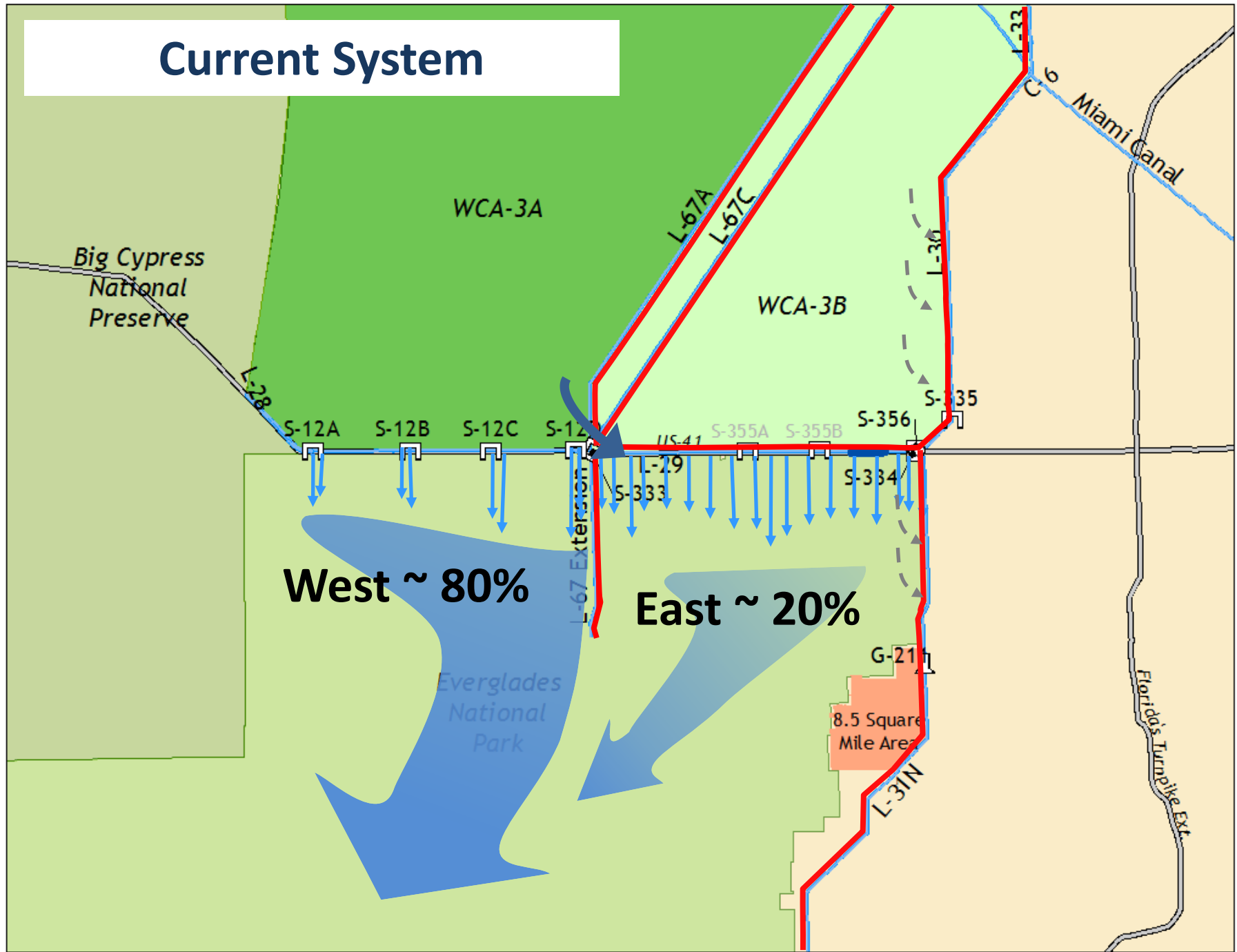
● Un-Impacted
5-yr GM = 4 ppb
Range = 3 – 5 ppb

GM = geometric mean
Range = annual average

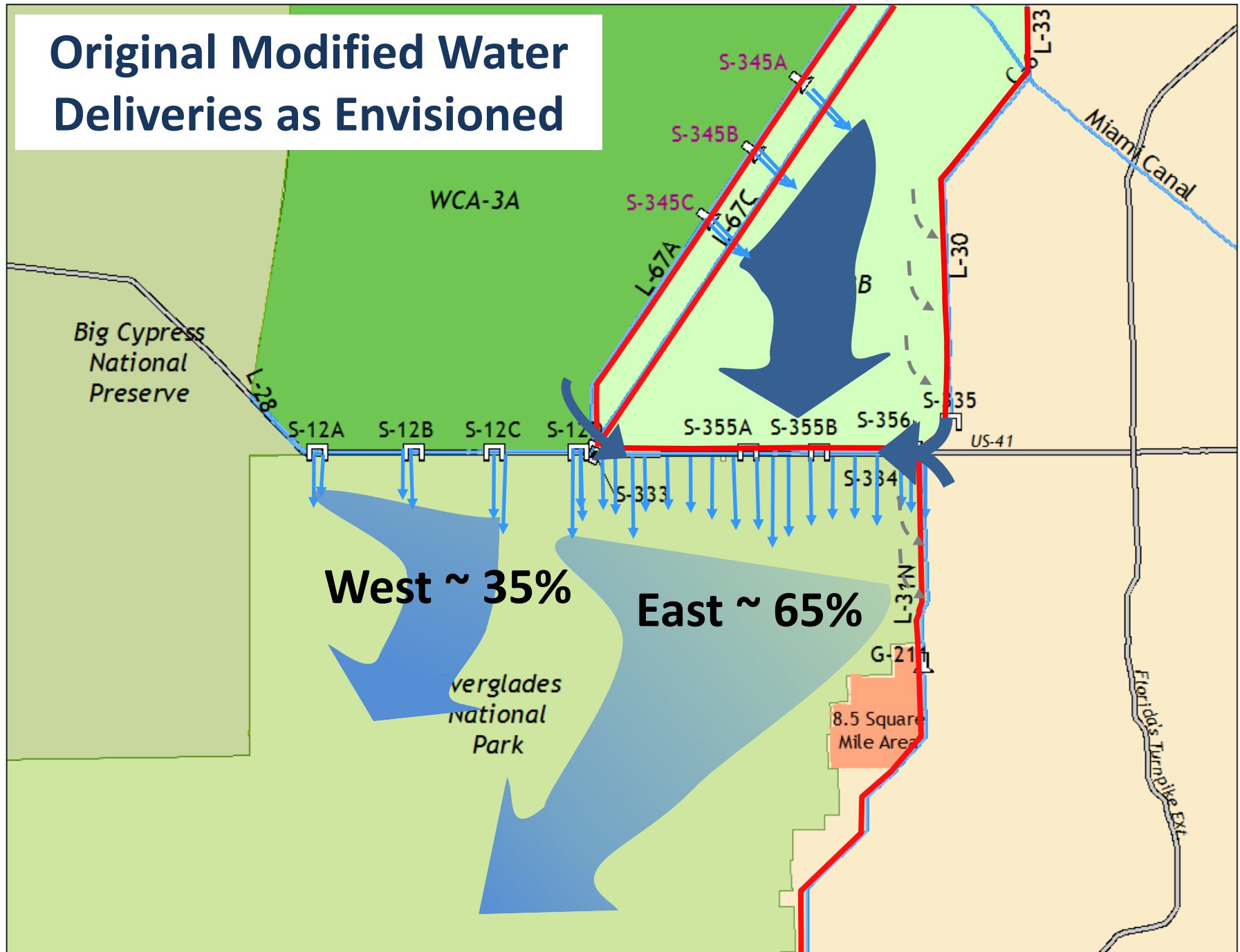


The Changing System with Mod Waters & CEPP

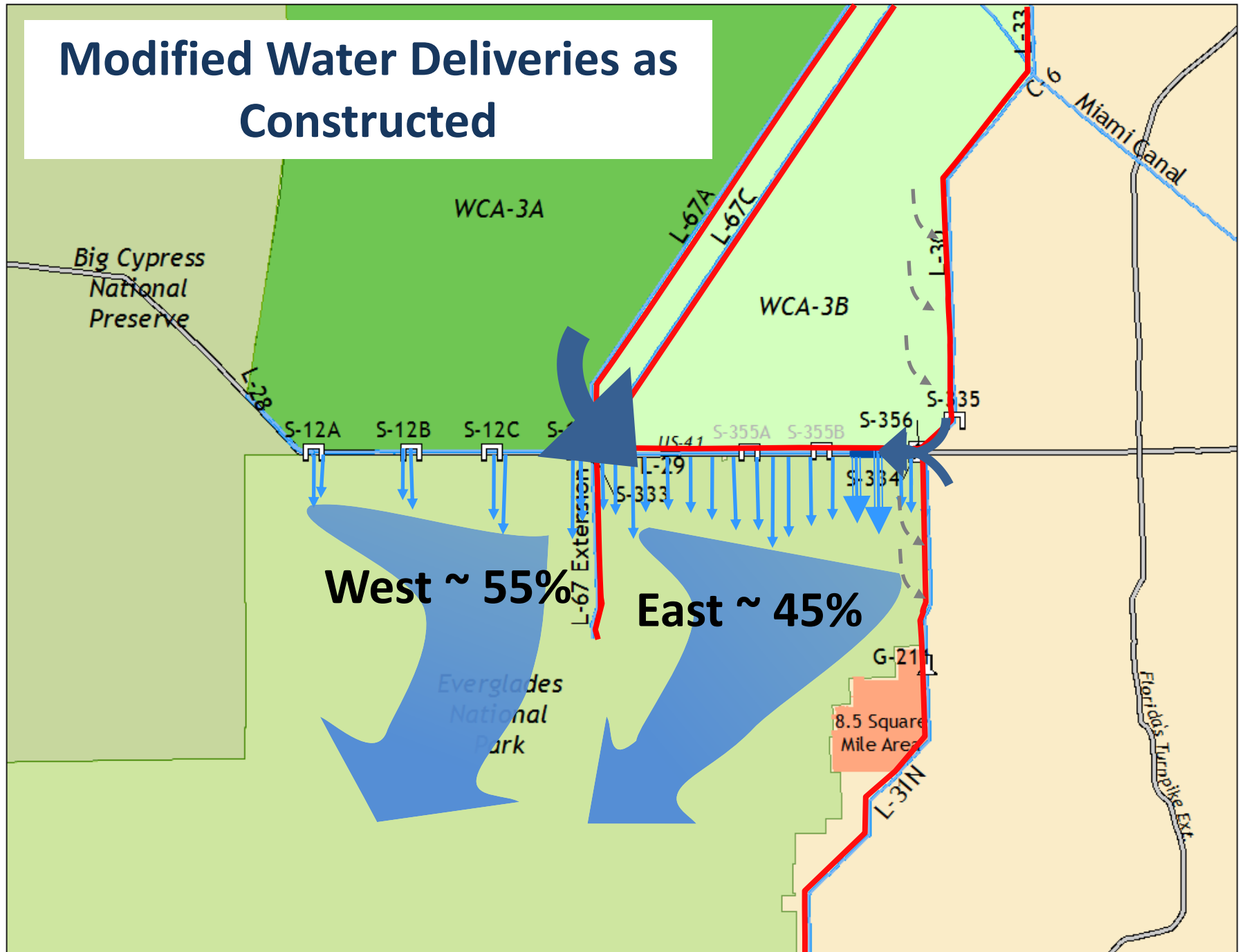
Current System



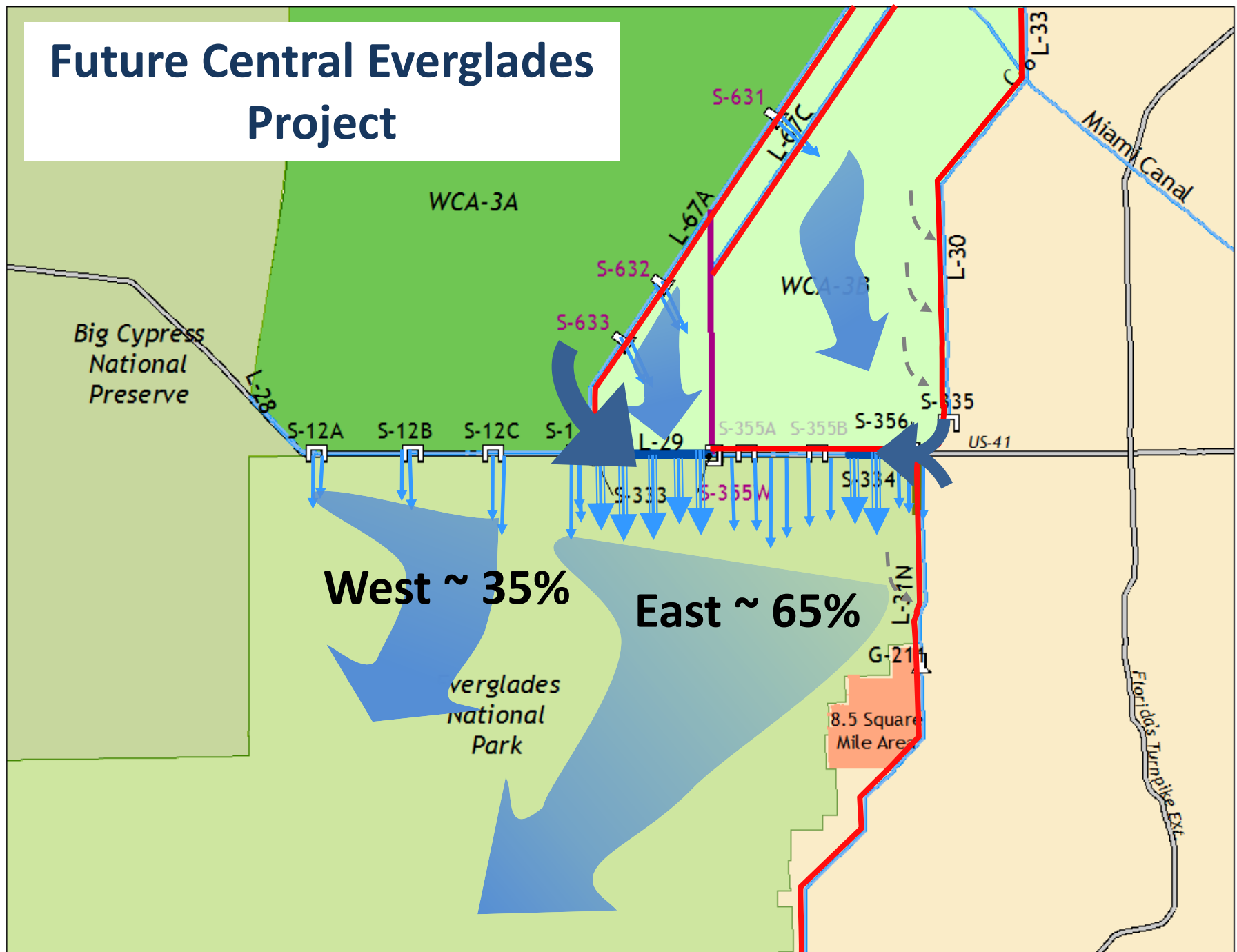
Original Modified Water Deliveries as Envisioned



Modified Water Deliveries as Constructed



Future Central Everglades Project





Conclusions and Path Forward

- Inflow TP is low, yet sensitive to hydrology, wet/dry seasons and climatic cycles
- TP also varies with flow type (marsh vs canal), location (western vs eastern SRS) and volume (increases in drier periods)
- Even small variations in TP can be important when limit is very low
- Recognize the system will continue to change over time
- Evaluation underway to consider hydrologic variability, changes in delivery system, and measurement uncertainty



Discussion